Enhancing heat transfer in vortex generator-type multifunctional heat exchangers

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Résumé en anglais	Global and local analysis of the heat transfer in turbulent vortical flows is studied using three-dimensional numerical simulations. Vorticity is generated by inclined vortex generators in a turbulent circular pipe flow with twelve different configurations that fall into three categories. In the first category are rows of trapezoidal vortex generators in different arrangements; in the second category the vortex generators are fixed at certain distance from the tube wall, and the third category has vortex generator rows between which a row of small protrusions are inserted on the tube wall. First, a global analysis of the thermal performance is performed for all these configurations, which are also compared with other heat exchangers from the literature. New correlations for the friction factor and Nusselt number are then obtained. Local analysis of the effect of the flow structure on the temperature distribution is carried out for the four configurations showing the best performances. The local analysis involves studying the streamwise vorticity flux to characterize the convective transport process, the turbulent kinetic energy characterizing the turbulent mixing, and finally the local Nusselt number.
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